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PROTECTION

FROM

LIGHTNING.

THE WURTS

Non-Arcing Metal Lightning Arrester

— FOR —

ALTERNATING CURRENTS.

Westinghouse Electric & Manufacturing Co.

PITTSBURG, PA.

DISTRICT OFFICES:

BOSTON, 620 Atlantic Avenue.
NEW YORK, 120 Broadway.
CHICAGO, Pullman Building.
PHILADELPHIA, Girard Building.
ST. LOUIS, American Central Building.
SAN FRANCISCO, Crocker Building.
CHARLOTTE, N. C.

Edward F. Anderson Co., Ltd.
Printers.
57 Park Ave., Pittsburg.

INTRODUCTION.

Owing to the ineffective and unreliable operation of lightning arresters available for the protection of electrical apparatus the Westinghouse Electric and Manufacturing Company some years ago undertook the improvement of this class of instrument; and now, after a long series of elaborate and costly experiments, we are able to offer, as the result of persistent and scientific research, the Non-Arcing Metal Lightning Arrester, an instrument which has already far exceeded our most sanguine expectations.

It is therefore with refreshing satisfaction that we present in this pamphlet a few of the many letters received from individuals and corporations

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that have used and thoroughly tested our apparatus and are now able to highly commend the service which it has given.

The brief description of this instrument given in the following pages may serve as a general explanation, but we earnestly solicit correspondence with any who may desire more definite information or estimates regarding this type of apparatus.

Respectfully,

Westinghouse Electric & Manufacturing Co.

PITTSBURGH, PA., February, 1893.

THE WURTS NON-ARCING METAL LIGHTNING ARRESTER.

FOR ALTERNATING CURRENT CIRCUITS.

One of the most important requirements for the complete equipment of many light and power stations is a practical means of protecting the system from the destructive effects of lightning. As is now thoroughly understood, electric wires become charged from the atmosphere, especially during thunder storms, with an electric potential different from that of the earth. There is a tendency for this charge to pass to earth, and unless some other path be provided it will probably follow the line into the station and destroy the insulation of some vital part of the system. A reliable and satisfactory lightning arrester for the protection of all apparatus on any system has been greatly demanded. The large variety of instruments already produced prove the urgency of the demand and indicate the difficulty there has been in meeting it.

An ideal arrester, to fulfill the purpose for which it is designed, should have no moving parts.

It should have a very small air gap.

It should be free from inductive resistance, such as is offered by a coil of wire.

It should be always ready for a discharge.

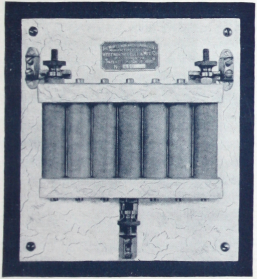
It should operate so quickly that there will be no short circuit or large rush of current on the line.

It should not require inspection.

Such an ideally perfect instrument for alternating current circuits has actually been secured by the brilliant discovery of Non-Arcing Metal.

It has been found that certain metals, belonging to the zinc and antimony groups, will not maintain an alternating current arc between adjacent dynamo terminals composed of these metals. As a result of a long series of elaborate experiments made by the Westinghouse Company a certain alloy of some of these metals has been discovered which will prevent the maintenance of an arc without the deterioration accompanying and prohibiting the use of the pure metal.

By employing this non-arcing alloy the ideal lightning arrester is obtained, for the lightning is offered an easy path to earth by jumping minute air gaps between the electrodes, while the dynamo current which attempts to follow the lightning is interrupted by the peculiar and unexplainable yet positive action of this metal.



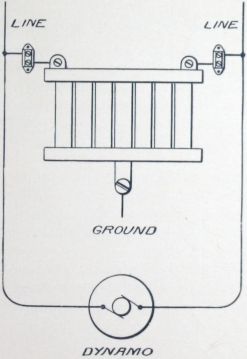
Type A Non-Arcing Station Arrester.

The construction of the arrester can be best understood by reference to the accompanying figure of the Type A Non-Arcing Arrester. It will be noted that there are seven independent cylinders of non-arcing metal, which are each 1″ in diameter and 3″ long, placed side by side with air gaps of $\frac{1}{64}$ of an inch. The cylinders are knurled, and thus present hundreds of confronting points for the discharge. The dynamo terminals are connected to the extreme cylinders and the middle cylinder is connected with the ground. See cut on page 9. The arrester is therefore DOUBLE POLE, that is, one arrester is sufficient for both sides of the circuit. When the lines become charged the discharge spark passes across between the cylinders from the line terminals to the ground terminal. In ordinary arresters with an air gap, the lightning discharge is followed by a short circuit of the dynamo which is liable to destroy the instrument and burn out an armature unless some special means be provided to open the circuit. In a common type of arrester this is accomplished by means of a fuse which, after the instrument has acted, must be replaced before the instrument is ready for another discharge; *meanwhile the line is left unprotected.*

With the non-arcing arrester the dynamo current does not continue to follow the discharge; its circuit is not left unprotected for an instant; the instrument does not deteriorate; is entirely automatic in action, and will handle frequent and persistent discharges with perfect facility.

Furthermore, it is impossible to fuse the metal cylinders together. The metal itself will not sustain an arc or become fused by it; hence with a lightning arrester constructed of this material all possibility of vicious arcing and short circuits are avoided. There are no moving parts, no coils to impede the passage of the lightning discharge, and in fact nothing that requires either adjustment or attention.

Diagram of Connections.



The following test proves in a striking manner the claims made in behalf of our instrument. Connect a Type A arrester, as shown, and a switch in parallel with a 1000-volt dynamo; bridge each of the six air gaps with a very small crumb of tin foil to start the short circuit; then, on closing the switch, the short circuit established will be so instantaneously interrupted that three, and often four, of the tinfoil crumbs will remain unfused. Had other than non-arcing metal been used under similar circumstances, it is needless to say that the apparatus would have been instantly reduced to a shapeless mass.

NON-ARCING METAL ARRESTERS IN SERVICE.

Although non-arcing lightning arresters are new, they have been extensively introduced. Last summer more than 2000 were in actual service in different parts of this country, on 1000, 2000 and 3000-volt alternating current circuits, many of them being in places where formerly great difficulty had been experienced with lightning discharges. The *universal opinion* is that the non-arcing arresters are *perfect. Not one of the many arresters we have sent out has ever been returned as unsatisfactory, and we have yet to hear of a single instance in which any of our instruments have failed to do all that is claimed for them.* Certainly an unprecedented record in the history of lightning arresters.

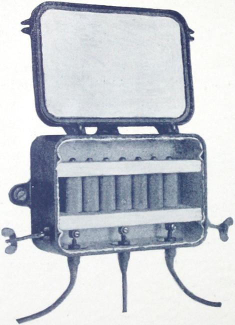
Hereafter are given some of the many and flattering testimonials received from the users of our apparatus, and we gladly refer to them any persons doubting the ability of our arresters to do all that we claim.

As will be noticed, in some instances the performance has been most remarkable, *e. g.*, lightning sparking across the arresters incessantly, without the slightest interruption of the service or damage to the arresters. In other cases there occurred only a very slight flash at the arrester which would not have attracted attention had not the attendant been looking directly at the instrument.

An arrester which had endured most severe service last season was by request returned to us. The cylinders were carefully examined, but aside from a multitude of small black spots and an almost imperceptible marring of the surfaces, the instrument was as perfect as when shipped from the factory.

LINE ARRESTERS.

Repeated experience has demonstrated that excessive discharges, by reason of their oscillatory character, will not easily follow any considerable length of line. It is not to be expected, therefore, that such discharges will follow long and crooked lines back to the station and there discharge to earth through a station arrester. The line is consequently not protected by the station arrester, and severe strains are brought upon the converters. If excessive charges do reach the station the discharge is liable to split and divide itself at the arrester, part passing through the dynamo and part across the air gap. Such experience as this and the loss of many converters has fully demonstrated the necessity



TYPE C NON-ARCING LINE ARRESTER.
(Open for inspection.)

of line arresters, not only to protect the converters, but also to relieve the line of excessive charges which might prove too great for complete discharge through the station arrester, and which would injure some vital part of the apparatus.

The especial difficulty in securing an arrester for line service is easily recognized, since the arrester is placed in a position where it cannot be readily inspected or adjusted. The beautiful simplicity of the non-arcing arrester, and the fact that there is nothing to deteriorate or wear out or to be examined or adjusted, has solved the important and difficult problem of a reliable and trustworthy line arrester for high tension alternating current work. The great advantages of entire absence of coils and of moving parts, and the fact that there is absolutely no destructive arc or possibility of short circuit, speak for themselves. We are confident in asserting that our types of non-arcing arresters for line use are the only ones now on the market which can be trusted on the line. This arrester can, of course, be connected to any circuit, irrespective of its current capacity. An illustration of our line arrester is shown on the opposite page.

DISTRIBUTION OF ARRESTERS.

A properly protected electric system should have arresters distributed throughout its entire extent as follows:

There should be one on each feeder within the station just before it reaches the switchboard.

Arresters should be connected to long lines at frequent intervals, taking care to make the connections at particularly exposed points and at short turns in the circuit.

The arresters should be connected to the circuit so as to protect the converters in service.

It is very important that these arresters should have a good earth connection by as short and direct a line as possible, and, whenever practicable, the line to be protected should be brought directly to the arrester.

TYPES OF NON-ARCING METAL ARRESTERS.

We make six different types of non-arcing metal arresters. These are available for all alternating current circuits and the Westinghouse, Brush and Scuyler arc circuits.

Any information concerning the arresters will be cheerfully given, and estimates and prices gladly furnished upon application.

In order to recommend the proper type of this arrester it is desirable that we know the voltage, the number of alternations and the make of generator with which the arresters are to be used.

TESTIMONIALS.

Williams Valley Light, Heat and Power Company.

LYKENS, PA., Dec. 6, 1892.

MR. LEMUEL BANNISTER,
Vice Prest. and Gen. Manager Westinghouse Elec. and Mfg. Co.,
Pittsburg, Pa.

DEAR SIR:—In reply to your inquiry under date of November 11th, regarding the action of your Non-Arcing Metal Lighting Arrester, will say that we have been using several of them for some time on circuits of 2400 volts, and the only thing I can say is that they are perfection itself.

Yours very respectfully,

(Signed.) H. G. WILLIAMS,
GENERAL MANAGER.

H. T. HOWELL, President. E. B. STURGES, Treasurer. ARTHUR H. JONES, Superintendent.

Suburban Electric Light Company.

Plant, No. 1232 Washington Avenue. Office, Commonwealth Building.

SCRANTON, PA., Nov. 16th, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN:—In reply to yours of the 11th inst. will say we have had one of your Lightning Arresters on our alternating lines for about one year. During the past season we were visited by some severe electrical storms, but experienced no trouble in running through, the arrester taking good care of us.

Respectfully yours,
(Signed.) SUBURBAN ELEC. LIGHT CO.,
A. H. JONES, SUPT.

G. C. MOSES, Treasurer, Bath, Me. E. E. LARRABEE, Manager, Bennington, Vt.

Bennington Water Power and Light Company.

BENNINGTON, VT., Nov. 21st, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN:—In reply to your inquiries of Nov. 11th about our Lightning Arresters, will say ours work to perfection.

Not having room for them on the switch board, we put them on the outside and built small houses for them, so we have had no lightning in the station this year.

Yours truly,

(Signed.) E. E. LARRABEE.

Lewiston and Auburn Electric Light Company.

Thomson-Houston System.

AUBURN, MAINE, Nov. 15th, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN :—In reply to yours of the 11th asking about the working of the Non-Arcing Metal Lightning Arresters, I will reply by saying that we used one last summer on our No. 2 alternating machine of your make. The lightning came in a number of times and went to ground without doing any damage to the machine or arresters. Our T. H. arresters gave out twice, and we could not keep them from being destroyed by arcing.

Yours respectfully,

(Signed.) F. E. BISBEE,
SUPERINTENDENT.

CYRUS CHAMBERS, JR., President.
JOHN S. GERHARD, Secretary.

JOSEPH R. RHOADS, Treasurer.
WILLIAM HOOPES, Superintendent.

Bala and Merion Electric Company,
Cynwyd, Pa.

CYNWYD, November 13, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN:—Your favor of the 11th inst. is at hand and we would say that we have been using the Non-Arcing Type Lightning Arrester for several months and consider it successful. Previous to its adoption we lost one or more transformers during every electrical storm, but since we have distributed the non-arcing arresters liberally over our line we have not lost a single transformer. We have had some very heavy electrical storms during the past season, and on three occasions trees have been shattered within a short distance of our lines. Each of these occasions was accompanied by a heavy discharge across our station arresters, but no damage was done, so that we have both practical and visual evidence of the value of this sort of protection.

Yours respectfully,
(Signed.) BALA & MERION ELECTRIC CO.,
Per W. HOOPES, SUPERINTENDENT.

Amherst Gas Company.

AMHERST, MASS., NOV. 23, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN:—Your letter of November 11th was duly received. In regard to "Lightning Arrester," about which you wrote, would say we put five of them on our lines early in the season. Our lines were struck by lightning several times since we put them on, and we have not suffered any damage of any consequence. We feel that they have saved us, in protecting our lines and converters, a good deal of money.

Yours respectfully,
(Signed.) AMHERST GAS COMPANY,
By GEO. CUTLER, Treasurer.

Department of Public Works, Bureau of Public Lighting.

D. HUNTER, JR., Superintendent.

ALLEGHENY, PA., November 2, 1892.

MR. LEMUEL BANNISTER,
Vice President, Westinghouse Electric & Manufacturing Co.
Pittsburg, Pa.

DEAR SIR:—Replying to yours of the first, it affords me great pleasure to inform you that your Non-Arcing Metal Lightning Arresters, which have been in use on our circuits during the past season, have in every instance performed the work required of them in a most thorough manner, as we have not had any trouble whatever in our station caused by lightning. That there was cause for trouble is very evident as the arresters show plainly that they have done considerable work without damage to the arresters. We have reached that point whereby the most severe storms cause no fear in our station. This feeling of confidence is all due to your valuable arresters.

Yours truly,

(Signed.) D. HUNTER, JR.

The Elmira Illuminating Company.

ELMIRA, N. Y., November 17, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.
Pittsburg, Pa.

GENTLEMEN:—In reply to your letter of November 10, regarding Lightning Arresters, we would say that we have two of the Non-Arcing Arresters in use, and during the past summer these arresters were in operation during six severe thunder showers. Upon one occasion the lines were struck in three different places, but, notwithstanding this, the arresters took care of the current without the machine tenders knowing anything about it. We found, upon examination, where the current had crossed from bar to bar leaving scarcely a perceptible mark. We have known positively of nine discharges passing through one of them. To all appearances they are in just the same condition as when erected.

Yours truly,
(Signed.) THE ELMIRA ILLUMINATING CO.
F. A. CHENEY, General Manager.

G. E. CLAFLIN. W. H. BLOOD, JR. A. M. MILLER.

The Franklin Electric Company,

535 Delaware Street.

KANSAS CITY, MO., November 4, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN:—Answering your favor of November 2d, in regard to our experience with the Non-Arcing Metal Lightning Arrester, would say that we have used several, the worst case being where they were on a 2000 volt circuit which is connected with a compound machine, and although they have passed through many severe lightning storms, they were always able to carry off the discharges. They went through some of the severest storms that have ever occurred in this part of the country, and many dynamos in the neighborhood were burned out, while those protected by these arresters were unaffected. We do not see how anything could work better than these.

Yours truly,
THE FRANKLIN ELECTRIC CO.,
BY W. H. BLOOD, JR.

Erskine Park.

LENOX, MASS., October 14, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.
Pittsburg, Pa.

GENTLEMEN: — Your Non-Arcing Metal Lightning Arrester has certainly been properly named, for it is a non-arcing arrester in every sense of the word.

During the past few months a number of severe storms have passed over this section of the country, through all of which these non-arcing arresters have manifested their marvelous ability to discharge the line of the static current without permitting our 1,000 volt circuits to arc across them. I have often seen the lightning crash across the arresters two or three times in less than two seconds, and on one occasion have noticed the lightning crash across one of these arresters probably forty times.

I have never noticed an arc formed across these arresters of such duration as to cause the least noticeable flicker of the lights.

These Non-Arcing Metal Lightning Arresters certainly are eminently superior to any arrester heretofore manufactured.

(Signed.) PETER McGOLDRICK,
ELECTRICIAN.

The Saratoga Gas and Electric Light Company.

SARATOGA SPRINGS, N. Y., Oct. 25, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.,
Pittsburg, Pa.

GENTLEMEN:—In regard to lightning arresters, the "Wurts Arrester" is the best I have ever seen. My experience with it has been all that could be desired.

Since having them on our switchboard we have had three of the most severe thunder showers that I have ever seen—and we got our share of lightning—but the Wurts Non-Arcing Lightning Arrester took care of its part of the work to such an extent that it carried twelve or fifteen discharges to ground during each shower with scarcely a vibration on the instruments or a strain on the belts, also without blacking arrester to speak of, while an arrester of another make burned out and held arc to ground until we could shut the circuit down.

After my experience with the Wurts Non-Arcing Arrester I shall never be satisfied with any other.

Yours truly,

(Signed.) R. A. SNYDER,
ELECTRICIAN.

The Philadelphia & Reading Railroad Company.

Office, Superintendent of Telegraph.

READING, PA. November 15, 1892.

WESTINGHOUSE ELECTRIC & MFG. CO.
Lemuel Bannister, Esq., Vice President and Gen. Manager,
Pittsburg, Pa.

DEAR SIR:—Replying to your favor of the 11th inst., I beg to advise that early in the season we had six of our arc light circuits equipped with your Non-Arcing Metal Lightning Arresters, and am pleased to state that we were not troubled a particle on these circuits by reason of the lightning during the summer season, whilst prior to the placing of these arresters we had two armatures burned out.

In our Reading yard we have a short circuit which I did not deem necessary to equip with the arrester, but found we experienced considerable trouble on this particular circuit. We have now placed arresters on this circuit and feel that we are amply protected.

If we could have had the benefit of these arresters during the previous season I am satisfied we would have saved the armatures above referred to.

Yours very truly,
E. R. ADAMS,
SUPERINTENDENT TELEGRAPH.

Brookline Gas Light Company.

Office, 1 Beacon Street, Room 52, Boston. Works at Brookline and Allston.

BOSTON, September 27, 1892.

MR. ALEXANDER JAY WURTS,
Westinghouse Electric & Mfg. Co.,
Pittsburg, Pa.

DEAR SIR:—I am pleased to inform you, after a conference with our assistant superintendent in charge of the electrical department at our station, that the three Non-Arcing Metal Lightning Arresters in use on our 2000-volt circuit have been in use in our station during the summer through several storms, and have acted well and without arcing. I would state further that I am personally cognizant of four lightning charges passing through these arresters without producing any arc, yet I see in your circular that you recommend for two or three thousand-volt circuit a lightning arrester with twenty air spaces or twenty-two non-arcing metals. You know that our circuit is two thousand volts, and it would seem as if the seven air spaces provided in the lightning arresters sent us last spring are sufficient to prevent arcs.

Yours truly,

(Signed.) BROOKLINE GAS LIGHT CO.,
ROBT. AMORY, PRESIDENT AND MANAGER.

The Standard Light & Power Manufacturing Company.

MONTPELIER, VT., October 14, 1892.

ALEXANDER J. WURTS, ESQ.
Pittsburg, Pa.

DEAR SIR:—We have your Non-Arcing Metal Lightning Arrester on all our alternating circuits.

Our Heisler system consists of two circuits, each about 15 miles long, in a section of country peculiarly subject to electrical storms. We placed the arresters in the station, and one on each circuit about 5½ miles out. We found by experience that the Heisler current (500-30 c. p. machine) would not allow a short circuit across one air gap, so we placed "jumpers" across the outside air gaps, but these were removed by mistake from the arresters at the station. The first discharge we received was a very severe one, the lightning striking the line poles about a mile out, setting the regulator box on fire, but doing no damage, as the lights were out less than two minutes. The arresters showed a heavy discharge and the "jumpers" were replaced, leaving one air gap between line and ground. We have passed through several storms since without any trouble on these lines.

We have three circuits using the T. H. alternating system, with the latest improved T. H. arresters in the station. As you will remember we lost four armatures on these circuits last year, and nine transformers. This season we placed one of your arresters on each circuit about one mile from the station. The lines have been struck twice in the town, doing no damage except to blow some fuses. The arresters have received no repairs and, although they show several discharges, are apparently all right. The last storm we had, the lightning struck near the station, followed in through the T. H. arresters and burned out an armature.

We credit the difference in losses, between this year and last, to your arresters.

Yours truly,

(Signed.) W. E. Laird,
Superintendent.

The Missouri Electric Light and Power Company.

American Central Building, Broadway and Locust St.

ST. LOUIS, September 27, 1892.

MR. ALEXANDER JAY WURTS,
Westinghouse Electric & Mfg. Co.
Pittsburg, Pa.

DEAR SIR :—Having just returned from a trip to New York, your favor of the 20th inst. has not been answered before.

I do not wonder that you have difficulty in pursuading customers of the practicability of your Non-Arcing Lightning Arresters, as at first sight it seems incredible that such a device could work. We have, however, had about 200 of them on our lines for several months, and during all the severe lightning storms of the past spring and summer we experienced no trouble of any kind on our lines or in our stations. We have never had a short circuit on our lines during a storm, which would indicate that the arresters promptly broke the arcs as soon as they were formed; neither have we had any arresters burned out or in any way disabled. From my experience with these arresters I consider them superior to any device which has ever been made before for the purpose, and more simple and effective than I ever imagined a lightning arrester could ever be made. How to prevent the occasional destruction of our converters and switchboard devices by the severe lightning storms which we frequently have here has been a very great problem for the last two years. From our experience during the past summer, I now think we have the problem solved by the use of a large number of your Non-Arcing Lightning Arresters placed at frequent intervals along the line. We also have a lightning arrester on each circuit where it enters the building, but these are rarely called into service, as those on the line seem to be sufficient to take care of all discharges.

I would be most pleased to recommend your arresters very highly to any one you may refer to me.

Yours very truly,

(Signed.) HERBERT A. WAGNER,
SUPERINTENDENT.

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